

onesided injury to the brain, the tension of the symmetrical muscles is no longer the same. Loeb applied this concept to animal behavior in general and concluded that actions of the animal that appear to be expressions of will and purpose are in reality a complex of such "forced movements," which are mechanistically determined. The sexual behavior of man, Loeb says, is also a complex of forced movements determined by chemical stimuli in his blood, including hormones, toxins, etc.

According to Loeb, the animal body is a chemical machine having no power of self-determination and acts in tropistic response to stimuli. Whether the stimuli that control behavior are external or internal (endocrine secretions), in either case the activity of the organism is tropistic, automatically responding to these stimuli. So-called instincts, in Loeb's opinion, are really complexes of tropisms. In the case of sexual behavior of animals during the mating seasons, in such case the stimuli consist of certain seasonal electrical changes in the atmosphere and environment, which, acting on the sex glands of the animal, lead to the production of hormones that determine sexual behavior. Loeb writes:

"Hormone produced by definite tissues therefore influence the instincts. We want to show that this influence is due to a modification of tropistic reactions by the hormones." The sexual behavior of the organisms may be considered as a complex of chemotropisms, or automatic reactions evoked by chemical stimuli in the bloodstream and is not due to instinct as formerly supposed.

In evidence of his conception of sexual behavior as a chemotropism, Loeb cites the example of the *Fundulus* fish, which sheds its eggs at the mating season as a result of a stereotropism, resulting from contact with another fish. If the sexes are separated at this time, the same reaction is induced by the fish coming in contact with the glass walls of the aquarium. Whitman has observed a similar sexual stereotropism among male pigeons which will mate with solid objects in their field of vision if kept in isolation during the mating period. On the basis of such observations, Loeb concludes: "These few examples may suffice to show that the theory of tropism is at the same time the theory of instincts if due consideration is given to the role of hormones in producing certain tropisms and suppressing others. A systematic analysis of tropisms and hormones will probably yield rich returns."

In the case of higher organisms, Loeb considers the mating instinct to be determined by tropisms aroused by specific internal secretions produced by the endocrine glands. Thus, while the persistent courtship of a human male for a definite female may appear as an example of persistent will, yet, in Loeb's opinion, it is a complicated tropism in which sex hormones and memory images are the determining factors. Removal of the sex glands abolishes the courtship and replacing the sex glands by those of the opposite sex may lead to a complete reversal of sex instincts. What appears at first sight as persistent will is, therefore, essentially a tropistic reaction.

Indicating the fact that his theory of tropisms opens up a new biochemical approach to problems of neurology and psychiatry, in his book, *The Mechanistic Conception of Life*, Loeb says: "I believe that the investigation of the conditions that produce tropisms may be of importance for psychiatry. If we can call forth in an animal which drives it irresistibly into a flame; if the same thing can be brought about by means of a secretion of the reproductive glands, we have given, I believe, a group of facts, within which the analogies necessary for psychiatry can be called forth and experimentally investigated."